Permit Rationale

Date: February 8, 2016

Permit Writer: Ryan Olive

Facility Name: Mason City, City of STP

Location: County: Cerro Gordo
Latitude: 43 degrees 8 minutes 17 seconds
Longitude: 93 degrees 9 minutes 23 seconds

Region/ FO: **DNR FO#**2, Mason City

Design: Discharge to Winnebago River (A1, B(WW-1) HH)

Date Constructed: 2008
Flow: ADW: 6.8000 MGD; AWW: 14.9000 MGD; MWW: 21.6000 MGD
BOD5 28235.00 lbs./day
P.E. 169,072

Sources: Construction Permit 2008-0413-S dated 5/15/2008

Treatment Plant Description: Wastewater treatment is provided by an activated sludge wastewater treatment plant. Treatment consists of two raw sewage screens, grit removal, four primary clarifiers, two trickling filters, three intermediate clarifiers, two activated sludge basins, two final clarifiers and anaerobic digesters. The facility is also equipped with UV disinfection. The facility accepts domestic waste from the City of Mason City. The facility also has a pretreatment program and pretreatment coordinator to organize and manage industrial waste coming into the facility.

Wasteload allocation: WLA dated December 14, 2009 (Revised on February 1, 2016)

Antidegradation: Antidegradation is not applicable because the limits comprising this permit are at least as stringent as the limits used in the previous permit.

Impaired Waterbody: The following stream segments in the discharge route are on the 2014 impaired waters list:

- The Winnebago River for primary contact – indicator bacteria
- The Shell Rock River for fish consumption – mercury, primary contact – indicator bacteria
- The Cedar River for primary contact – indicator bacteria, primary contact and aquatic life – pH, drinking water – nitrate nitrogen, aquatic life – biological (mussels)
- The Iowa River for primary contact – indicator bacteria
- The Mississippi River for aquatic life – aluminum

Two TMDLs have been completed in the route of flow downstream from this facility for the Cedar River; one for *E. coli* (2010) and one for nitrate nitrogen (2006).

Please note that the results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving waterbody. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired waterbodies, which may provide watershed based wasteload allocations.

Limits

Effective from permit issuance to permit expiration

Parameter	Season	7-day ave **mg/L**	30-day ave **mg/L**	daily max **mg/L**	min	max	7-day ave **lbs/day**	30-day ave **lbs/day**	daily max **lbs/day**
$CBOD_5$	yearly	40	25	---	---	---	4,971	3,107	---
TSS	yearly	45	30	---	---	---	5,592	3,728	---
pH	yearly	---	---	---	6.5	9.0	---	---	---
Cadmium	yearly	---	0.0005424	0.004382	---	---	---	0.06132	0.5401
Chromium (VI)	yearly	---	0.01319	0.01625	---	---	---	1.491	2.002
Copper	yearly	---	0.01939	0.02725	---	---	---	2.239	3.362
Cyanide	yearly	---	0.006237	0.02234	---	---	---	0.7050	2.753
Mercury	yearly	---	0.0001799	0.001665	---	---	---	0.02034	0.2052
DO	Summer (June – Sept)	---	---	---	5.0	---	---	---	---
E. coli (Geomean)	summer (March-Nov)	---	---	126	---	---	---	---	---
NH3-N	As specified in WLA dated December 14, 2009 (Revised on February 1, 2016)								

Basis for limits:

$CBOD_5$ and TSS are consistent with Standard Secondary Treatment requirements with $CBOD_5$ and TSS mass limits based on design flows. Ammonia nitrogen, pH, DO, cadmium, chromium, copper, cyanide, mercury, and *E. coli* limits are based on the December 14, 2009 WLA.

Based on a review of the ammonia effluent data from the City, it is clear that the facility can comply with proposed ammonia limits outlined in this draft permit. This permit contains ammonia monitoring and limits that are effective at permit issuance.

A sample for fecal coliform bacteria was submitted with the application. The result was 2,585 org./100mL. *E. coli* is a component of fecal coliform. At the time of the last permit issuance EPA had not approved methods to test for *E. coli* for wastewater. The equivalent *E. coli* result is calculated based on an *E. coli* to fecal coliform ratio of 1:1.6. Therefore, the equivalent *E. coli* results 1,615.53 org./100mL. The facility discharges into a Class (A1) water body. The water quality standard for E. coli in a Class (A1) water body is a Geometric Mean of 126 org./100 ml and a Sample Maximum of 235 org./100 ml from March 15th through November 15th. The criteria apply at "end-of-pipe". This facility was also assigned limits of a Geometric Mean of 126 org./100 ml and a Sample Maximum of 235 org./100 ml in the Cedar River *E. coli* TMDL. However, the recent chapter 62 revision that became effective on Oct. 14, 2009 states "…that the daily sample maximum criteria for *E. coli* set forth in Part E of the 'Supporting Document for Iowa Water Quality Management Plans' shall not be used as an end-of-pipe permit limitation." Therefore, only the geometric mean limit of 126 org./100 ml applies to this facility. While the *E. coli* result of 1,615.53 org./100mL is above the WLA limit, the facility is equipped with a functional UV disinfection system that will be used to disinfect the treated effluent and therefore the Mason City STP is able to comply with the geometric mean limits from the December 14, 2009 WLA. *E. coli* limits will be effective at permit issuance.

The results of chloride and TDS samples submitted were 260 mg/L and 790 mg/L respectively. The chloride result of 260 mg/L was greater than 50% of 30-day average limit (459 mg/L) calculated in the December 14, 2009 WLA. Only one point of data was submitted and more data is required to determine if limits for chloride may be needed in the future. I am adding monitoring for chloride to the permit to help determine if reasonable potential for chloride exists.

The Department adopted chloride and sulfate standards to replace TDS. Sulfate and chloride are component of TDS. In order to determine whether the City's effluent could violate the sulfate WQS, the chloride sample result was subtracted from the TDS sample result. The resulting value was 530 mg/L and is well below the 30-day average and daily maximum (1,536 mg/L) sulfate limits calculated in the December 14, 2009 WLA. Therefore there is no reasonable potential for the discharge to violate the sulfate WQS and no sulfate limits have been proposed.

Mason City was given a total nitrogen allocation in the 2006 Nitrate TMDL for the Cedar River; however, the TMDL was found to have been based on incorrect assumptions and a lack of data. Therefore, after 2 years, the total nitrogen monitoring data required by the State's nutrient reduction strategy will be used to calculate a corrected wasteload allocation and corresponding average and maximum permit limits for Mason City. The permit will then be amended to include the total nitrogen limits.

The previous permit required regular monitoring for arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel and zinc. A reasonable potential review was conducted using the past 4 years of monitoring data. The results showed that no reasonable potential for limit exceedance existed in arsenic, lead, nickel and zinc and the monitoring for these metals were removed from this permit. The

data review did show reasonable potential for cadmium, chromium, copper, cyanide and mercury. Due to reasonable potential existing for these metals, monitoring and limits will be included in this permit.

The City of Mason City STP was also required to test for dissolved oxygen (DO), nitrate + nitrite nitrogen, Total Kjeldahl Nitrogen (TKN), oil and grease, and phosphorus.

Modeling conducted in the December 14, 2009 WLA determined that the effluent from the plant must maintain a minimum DO of 5.0 mg/L to ensure a minimum DO of 5.0 mg/L in stream for an allowed maximum effluent $CBOD_5$ of 40mg/L. The result of the DO sample submitted with the permit application was 5.5288 mg/L. Monitoring and limits are being included in the permit to ensure DO limits are met in June - September.

The oil and grease sample was <1.0 mg/L. We only have a narrative standard for oil and grease. In most cases if oil and grease is below 10 mg/L, there should not be a visible sheen.

The average phosphorus sample result was 5.7 mg/L. There are no Water Quality Standards (WQS) for phosphorus. The average nitrate + nitrite nitrogen sample result was 4.9 mg/L. The standard for nitrate applies only to Class "C" waters that are used for drinking water which the Winnebago River is not. The average TKN sample result was 0.83 mg/L. There are no WQS for TKN. Based on information currently available the Department cannot make a reasonable potential determination for the narrative WQS in IAC 567-61.2(3) specific to nitrogen and/or phosphorus. However, NPDES permits are protective of Iowa's narrative standards that apply at all times to all surface waters regardless of whether or not the standards are specifically included in the permit. The Department is addressing nitrogen and phosphorus discharges from point sources through the Iowa Nutrient Reduction Strategy.

Although the detection levels for 3,3-dichlorobenzidine and hexachlorobenzene in Part B were above the WQBELs, I see no potential for the discharge from the City of Mason City STP to result in a 3,3-dichlorobenzidine or hexachlorobenzene WQS violations due to the fact that these chemicals have been banned in the United States.

All other parameters in Part B of the application did not show any reasonable potential for limit exceedance.

Backsliding: The permit has been reviewed for anti-backsliding according to sections 303(d)(4) and 402(o) of the Clean Water Act and 40 CFR 122.44. All limits and conditions proposed in this permit are at least as stringent as those in the previous permit. Backsliding is not occurring.

Effluent Toxicity: Toxicity tests have not been conducted by US EPA Region VII. The Department is incorporating toxicity and limits testing into the permit as per revised Rule 567 IAC 63.4(455B) which became effective June 19, 1991. The dilution percentages for effluent toxicity testing specified in the January 7, 2016 WLA are 98.5% of effluent and 1.5% of dilution water. An annual monitoring frequency is specified in the permit.

Monitoring Basis: Compliance and operational monitoring are based on Chapter 63 IAC, Tables II and III. Category > 105,000.

Special Monitoring: See pages 12 & 13 of the permit for the total nitrogen, ammonia nitrogen, chromium (VI), metals and *E. coli* special monitoring language.

Sludge: Sludge will be land applied according to Chapter 567 IAC 67 land application rules, or otherwise disposed of in accordance with federal regulations specified in 40 CFR Part 503. No adverse environmental impacts have been identified.

Pretreatment: The City's Pretreatment Program was approved on October 4, 1983. The last inspection was completed by Carl Berg, DNR FO #2, on March 27, 2012.

This permit requires the City to evaluate the adequacy of its local limits to meet the general prohibitions against interference and pass through listed in 40 CFR 403.5(a) and the specific prohibitions listed in 40 CFR 403.5(b). The permit also requires an annual pretreatment report describing the pretreatment program activities of the previous year be submitted to the department by March 1st of each year. Additionally, The City shall evaluate the approved pretreatment program for compliance with 40 CFR 403 and Iowa Administrative Code 567 – Chapter 62, specifically with regards to the pretreatment streamlining rule published in the Federal Register on October 14, 2005.

Comments: The permit contains a requirement for the City to conduct a two year feasibility study to determine the facility's ability to remove nutrients (total nitrogen and total phosphorus). The requirement is in based on the 2013 Iowa Nutrient Reduction Strategy. The facility is required to evaluate the feasibility and reasonableness of reducing the amounts of nitrogen and phosphorus discharged into surface water. The report shall be submitted no later than *[24 months from permit issuance date]*.

Dec. 14, 2009
Revised on Feb. 1, 2016 *NPDES # 6- 17-50-0-01*

City of Mason City

(Please do not microfiche this document.)

This Package Contains

WASTELOAD ALLOCATION CALCULATIONS & NOTES

Please Do Not Separate

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Mason City, City of STP — Sewage File Number: 6-17-50-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =6.8 mgd AWW =14.9 mgd**				
CBOD	Secondary Treatment Levels Will Not Violate WQS				
Total D.O.	Minimum Concentration (mg/l)				
June – Sept.	5.0				
Ammonia – Nitrogen[1]					
January	9.9	15.6	909.7	**1908.1**	--
February	11.2	14.6	**1026.5**	**1788.7**	--
March	5.1	15.0	479.4	**1842.7**	--
April	3.7	15.9	352.2	**1965.0**	--
May	3.2	15.4	304.4	**1901.0**	--
June	2.2	14.7	215.7	**1807.7**	--
July	2.2	11.5	196.3	1429.1	--
August	2.0	13.0	179.0	**1615.5**	--
September	2.5	13.8	240.7	**1714.9**	--
October	5.1	16.0	481.2	**1966.8**	--
November	6.3	14.9	589.8	**1838.4**	--
December	7.4	16.2	689.0	**1999.4**	--
Bacteria	Geometric Mean (#org/100ml)		March 15th – November 15th		
E. coli[2]	126				
Chloride[3]	459	638	52,307	78,666	1/ week
Sulfate[3]	1,536	1,536	189,372	189,372	1/ week
Total Nitrogen[4]	--	--	934.8	1,530.1	--
pH	6.5-9.0				

For the acute WET test, use 98.5% of the effluent and 1.5% of dilution water.

Stream Network/Classification of Receiving Stream: Winnebago River (A1, B(WW-1) and HH)

Date Done: Dec. 14, 2009; revised on Feb. 1, 2016

Annual critical low flow in Winnebago River at the discharge point
30Q10 flow 10.636 cfs, 7Q10 flow 8.390 cfs, 1Q10 flow 6.500 cfs Harmonic mean flow 62.632 cfs

Excel Spreadsheet calculations [ ] Qual II E Model [ ] Qual II E Modeling date[ ]

Performed by: Connie Dou Approved By: Connie Dou

1. The bold ammonia nitrogen mass limits are governed by the TMDL based Total Nitrogen WLAs.
2. Cedar River *E. coli* TMDL based limit. Due to a recent revision to IAC567.62 (Chapter 62), sample maximum limit for bacteria is no longer required. Only geometric mean is required.
3. Chloride/sulfate limits are based on the new chloride/sulfate criteria that took effective on Nov. 11, 2009. Chloride/sulfate criteria are hardness dependent and the default hardness has been changed from 100 mg/l to 200 mg/l, effective Nov. 11, 2009.
4. Cedar River nitrate TMDL based limits adjusted based on the Nov. 20, 2008 memo "Deriving total nitrogen limits from the WLA in the Cedar River TMDL".

Antidegradation Review Requirement

A Tier II Antidegradation review is not triggered. Please see Section 2 for details.

By Connie Dou
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ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Mason City, City of STP — Sewage File Number: 6-17-50-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =6.8 mgd AWW =14.9 mgd**				
1,1,1-Trichloroethane	2.681E+01	2.681E+01	3.304E+03	3.304E+03	1/ week
1,1-Dichloroethylene	1.767E+01	5.483E+01	1.482E+03	6.758E+03	1/ week
1,2-Dichloroethane	9.207E-01	5.991E+01	7.721E+01	7.383E+03	1/ week
1,2-Dichloropropane	3.733E-01	3.733E-01	3.130E+01	3.130E+01	1/ week
2,3,7,8-TCDD (Dioxin)	1.269E-10	1.269E-10	1.064E-08	1.064E-08	1/ week
3,3-Dichlorobenzidine	6.968E-04	6.968E-04	5.843E-02	5.843E-02	1/ week
4,4' DDT	1.199E-06	1.117E-03	1.356E-04	1.377E-01	1/ week
Aldrin	1.244E-06	1.244E-06	1.043E-04	1.043E-04	1/ week
Aluminum	1.043E-01	7.616E-01	1.179E+01	9.386E+01	1/ week
Antimony	7.676E-01	7.676E-01	8.677E+01	8.677E+01	1/ week
Arsenic (III)	1.244E-01	3.453E-01	1.043E+01	4.255E+01	1/ week
Benzene	1.269E+00	1.675E+01	1.064E+02	2.065E+03	1/ week
Benzo(a)Pyrene	4.479E-04	4.479E-04	3.756E-02	3.756E-02	1/ week
Bromoform	3.484E+00	3.484E+00	2.922E+02	2.922E+02	1/ week
Cadmium	5.424E-04	4.382E-03	6.132E-02	5.401E-01	1/ week
Carbon Tetrachloride	3.982E-02	2.188E+01	3.339E+00	2.697E+03	1/ week
Chlordane	5.157E-06	2.437E-03	5.830E-04	3.003E-01	1/ week
Chlorobenzene	1.919E+00	1.635E+01	2.169E+02	2.015E+03	1/ week
Chlorodibromomethane	3.235E-01	3.235E-01	2.713E+01	2.713E+01	1/ week
Chloroform	1.170E+01	1.170E+01	9.808E+02	9.808E+02	1/ week
Chloropyrifos	4.917E-05	8.428E-05	5.559E-03	1.039E-02	1/ week
Chromium (VI)	1.319E-02	1.625E-02	1.491E+00	2.002E+00	1/ week
Copper	1.939E-02	2.725E-02	2.239E+00	3.362E+00	1/ week
Cyanide	6.237E-03	2.234E-02	7.050E-01	2.753E+00	1/ week
Di(2-ethylhexyl)phthalate	5.475E-02	5.475E-02	4.591E+00	4.591E+00	1/ week
Dichlorobromomethane	4.230E-01	4.230E-01	3.548E+01	3.548E+01	1/ week
Dieldrin	1.344E-06	1.344E-06	1.127E-04	1.127E-04	1/ week
Endosulfan	6.717E-05	2.234E-04	7.592E-03	2.753E-02	1/ week
Endrin	4.318E-05	8.733E-05	4.881E-03	1.076E-02	1/ week
Ethylbenzene	2.519E+00	2.300E+01	2.847E+02	2.834E+03	1/ week
gamma-Hexachlorocyclohexane (Lindane)	9.647E-04	9.647E-04	1.189E-01	1.189E-01	1/ week
Heptachlor	1.966E-06	5.280E-04	1.649E-04	6.507E-02	1/ week
Heptachlor epoxide	9.705E-07	9.705E-07	8.139E-05	8.139E-05	1/ week
Hexachlorobenzene	7.217E-06	7.217E-06	6.052E-04	6.052E-04	1/ week
Hexachlorocyclopentadiene	1.319E+00	1.319E+00	1.491E+02	1.491E+02	1/ week
Lead	9.227E-03	2.005E-01	1.043E+00	2.470E+01	1/ week
Mercury (II)	1.799E-04	1.665E-03	2.034E-02	2.052E-01	1/ week
Nickel	1.125E-01	8.564E-01	1.271E+01	1.055E+02	1/ week

By Connie Dou

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ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Mason City, City of STP — Sewage File Number: 6-17-50-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =6.8 mgd AWW =14.9 mgd**				
Nitrate as N*	3.249E+02	3.249E+02	4.005E+04	4.005E+04	1/ week
Nitrate+Nitrite as N*	3.249E+02	3.249E+02	4.005E+04	4.005E+04	1/week
para-Dichlorobenzene	2.279E-01	2.031E+00	2.576E+01	2.503E+02	1/week
Parathion	1.559E-05	6.600E-05	1.762E-03	8.134E-03	1/week
Pentachlorophenol (PCP)	2.193E-02	2.420E-02	2.479E+00	2.982E+00	1/week
Phenols	5.997E-02	2.539E+00	6.779E+00	3.129E+02	1/week
Polychlorinated Biphenyls (PCBs)	1.593E-06	2.031E-03	1.336E-04	2.503E-01	1/week
Polynuclear Aromatic Hydrocarbons (PAHs)	3.598E-05	3.046E-02	4.067E-03	3.754E+00	1/week
Selenium	5.997E-03	1.960E-02	6.779E-01	2.415E+00	1/week
Silver	3.859E-03	3.859E-03	4.755E-01	4.755E-01	1/week
Tetrachloroethlyene	8.212E-02	8.212E-02	6.886E+00	6.886E+00	1/week
Thallium	5.637E-04	5.637E-04	6.372E-02	6.372E-02	1/week
Toluene	5.997E-02	2.539E+00	6.779E+00	3.129E+02	1/week
Toxaphene	2.399E-06	7.413E-04	2.711E-04	9.135E-02	1/week
trans-1,2-Dichloroethylene	1.679E-01	1.679E-01	1.898E+01	1.898E+01	1/week
Trichloroethylene (TCE)	9.595E-02	4.062E+00	1.085E+01	5.006E+02	1/week
Vinyl Chloride	5.972E-02	5.972E-02	5.008E+00	5.008E+00	1/week
Zinc	2.189E-01	2.189E-01	2.698E+01	2.698E+01	1/week
Iron	1.015E+00	1.015E+00	1.251E+02	1.251E+02	1/week

* The mass limits will be controlled by the TMDL based Total Nitrogen WLAs.

By Connie Dou

WLA/permit limits for the City of Mason City's Mechanical Wastewater Treatment Facility

These wasteload allocations and water quality based permit limitations are for the City of Mason City's mechanical wastewater treatment facility. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and 'Supporting Document for Iowa Water Quality Management Plans,' Chapter IV, November 11, 2009. The chloride allocation/permit limits are based on the criteria that became effective on November 11, 2009.

1. BACKGROUND: The City discharges treated domestic wastewater from an activated sludge facility into Winnebago River. The Winnebago River is a A1, B(WW-1) and HH waterbody. The annual critical low flows in Winnebago River at the discharge point were estimated based on the Drainage Area Ratio method and flow statistics obtained at USGS gage station 05459500, located on Winnebago River at Mason City, Iowa.

Table 1: Annual Critical Low Flows

Location	Drainage Area (square mile)	Harmonic Mean (cfs)	Annual critical low flows (cfs)		
			1Q10	7Q10	30Q10
USGS Gage (05459500)	526.00	53.0[$]	5.5[$]	7.1[$]	9.0[$]
Outfall	621.59	62.632[@]	6.500[@]	8.390[@]	10.636[@]

[$]: USGS gage station statistic data
[@]: Estimated based on drainage area ratio method

2. ANTIDEGRADATION REVIEW REQUIREMENT:
According to the Iowa Antidegradation Implementation Procedure, effective February 17, 2010 (IAC 567-61.2(2).e), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

Table 2: Antidegradation Review Analysis

Item #	Factor or Scenario	Antidegradation Determination	Analysis/Comments
1	Design Capacity Increase	Yes ☒, No ☐, or Not Applicable ☐	1: New design capacity sheet attached
2	Significant Industrial Users (SIU) Contributing New Pollutant of Concern (POC)	Yes ☐, No ☒, or Not Applicable ☐	As indicated in the request form
3	New Process Contributing New Pollutant of Concern (POC)	Yes ☐, No ☒, or Not Applicable ☐	As indicated in the request form
4	Less Stringent Permit limits?	Yes ☒, No ☐, or Not Applicable ☐	1: Current limits sheet attached The ammonia nitrogen limits for some months are higher
5	Outfall Location Change	Yes ☐, No ☒, or Not Applicable ☐	
Conclusion and discussion: Due to Items 1, 4 a tier II antidegradation review is *typically* required. However, based on department guidance, permit limits that are affected by design capacity changes that occurred before September 30, 2010 do not apply retroactively (the construction permit for the increased capacity was issued in 2008). Since design capacities increased prior to this date, antidegradation review is not required in this case. A Tier II Antidegradation review is not triggered.			

3. TOTAL MAXIMUM DAILY LOAD (TMDL) LIMITATIONS:
The following stream segments in the discharge route are on the 2014 impaired waters list:

- The Winnebago River for primary contact – indicator bacteria
- The Shell Rock River for fish consumption – mercury, primary contact – indicator bacteria
- The Cedar River for primary contact – indicator bacteria, primary contact and aquatic life – pH, drinking water – nitrate nitrogen, aquatic life – biological (mussels)
- The Iowa River for primary contact – indicator bacteria
- The Mississippi River for aquatic life – aluminum

Two TMDLs have been completed in the route of flow downstream from this facility for the Cedar River; one for *E. coli* (2010) and one for nitrate nitrogen (2006). This facility was given a WLA in both TMDLs (see Section 4, below).

Please note that the results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving waterbody. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired waterbodies, which may provide watershed based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website:
http://www.iowadnr.gov/Environment/WaterQuality/WatershedImprovement/WatershedResearchData.aspx

4. CALCULATIONS: The wasteload allocations / permit limits for this outfall were calculated based on the facility's Average Dry Weather (ADW) design flow of 6.8 mgd and its Average Wet Weather (AWW) design flow of 14.9 mgd.

The water quality based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics:
To protect the B(WW-1) aquatic life use:
The acute and chronic criteria for the protection of B(WW-1) aquatic use should be met at the boundaries of the Zone of Initial Dilution (ZID) and the Mixing Zone (MZ), respectively. In this case, 25.0% of the 7Q10 flow and 2.5% of the 1Q10 flow in Winnebago River were used as the Mixing Zone (MZ) and Zone of Initial Dilution (ZID), respectively.

To protect the HH human health use:
For pollutants that are carcinogenic and have HH criteria, the HH criteria have to be met at the end of the MZ, which is 25% of the harmonic mean flow in the Winnebago River at the discharge point.

Final limits:
The acute limits are those calculated for the protection of B(WW-1) aquatic life use; the chronic limits are the more stringent between the protection of the B(WW-1) use and those for the protection of the HH use.

Ammonia: Standard stream background temperatures, pH's, and concentrations of NH3-N were mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream WQS criteria for the protection of the Winnebago River. Based on the ratio of the discharge flow to the River flow, 5% of the 1Q10 and 100% of the 30Q10 were used as the ZID and the MZ, respectively. The Winnebago River is a B(WW-1) stream, therefore, early life protection will begin in March and run though September.

The monthly background temperatures, pH, and NH3-N concentrations shown in Table 2 were used for the wasteload allocation/permit limits calculations based on the Year 2000 ammonia criteria. Table 3 shows the statewide monthly effluent pH and temperature values for mechanical facilities. Table 4 shows the calculated ammonia nitrogen limits for this facility.

Table 2: Background Temperature, pH and NH3-N Concentrations
For Use with Year 2000 Ammonia Criteria

Months	pH	Temperature (°C)	NH_3-N (mg/l)
Jan.	7.8	0.6	0.5
Feb.	7.7	1.2	0.5
March	7.9	4.3	0.5
April	8.1	11.7	0.5
May	8.1	16.6	0.5
June	8.1	21.4	0.5
July	8.1	24.8	0.0
August	8.2	23.8	0.0
Sept.	8	22.2	0.5
October	8	12.3	0.5
November	8.1	6	0.5
December	8	1.6	0.5

Table 3: Standard Effluent pH & Temperature Values for Mechanical Facilities

Months	pH	Temperature (°C)
Jan.	7.67	12.4
Feb.	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.7	22.1
July	7.58	24.1
August	7.63	24.4
Sept.	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

Table 4: Water Quality Based Limits for Ammonia Nitrogen

Months	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)
January	9.9	15.6	909.7	1908.1
February	11.2	14.6	1026.5	1788.7
March	5.1	15.0	479.4	1842.7
April	3.7	15.9	352.2	1965.0
May	3.2	15.4	304.4	1901.0
June	2.2	14.7	215.7	1807.7
July	2.2	17.9	196.3	2201.0
August	2.0	16.5	179.0	2029.9
Sept.	2.5	16.8	240.7	2065.5
October	5.1	16.0	481.2	1966.8
November	6.3	14.9	589.8	1838.4
December	7.4	16.2	689.0	1999.4

However, the limits shown in Table 4 are not the final limits. In order to for the CBOD5/Total dissolved oxygen not to violate water quality standards, the maximum ammonia nitrogen limits for the month of July, August and September were adjusted from 17.9, 16.5 and 16.8 mg/l to 11.5, 13.0 and 13.8 mg/l, respectively . Please see the next section for detail.

CBOD5/Total Dissolved Oxygen:
The Streeter-Phelps DO Sag model was used to simulate the CBOD5 decay and total Dissolved Oxygen (DO) dispersion behavior in the receiving stream after discharge. The criterion is that the total DO in the receiving stream cannot be less than 5.0 mg/l at all times. The parameters used in the Streeter-Phelps DO Sag model are: a waterway slope of 0.00087 (the water channel descends 10 feet over a distance of approximately 2.17 river miles) and a flow velocity of 0.11 fps in the Winnebago River (based on stream flow and UAA data obtained in summer of 2006: river width 65-100 feet, depth 32-48 inches). The background parameters are: total DO of 6.0 mg/l, BOD of 8.0 mg/l and ammonia-nitrogen of 0.0 mg/l in July and August and 0.5 mg/l for the months from September to June. The background and effluent temperatures are shown in Table 2 and 3. The USGS channel-control equation (Melching and Flores 1999) was used as the re-aeration model.

The Streeter-Phelps DO Sag modeling results show that for the months from October to May, the effluent from the treatment plant (with a maximum CBOD 0f 40 mg/l and ammonia nitrogen levels shown in Table 4) will not cause total DO in the receiving stream less than 5.0 mg/l. for the month of June, the minimum effluent DO has to be 5.0 mg/l. For the months from July to September, in addition to the minimum effluent DO of 5.0 mg/l, the calculated ammonia-nitrogen levels have to be lowered to make sure the discharge will not cause the total DO in the receiving lower than 5.0 mg/l.

***E. coli*:** The facility discharges into a Class (A1) water body. The water quality standard for *E. coli* in a Class (A1) water body is a Geometric Mean of 126 org./100 ml and a Sample Maximum of 235 org./100 ml from March 15th through November 15th. The criteria apply at “end-of-pipe”.

This facility was also assigned limits of a Geometric Mean of 126 org./100 ml and a Sample Maximum of 235 org./100 ml in the Cedar River *E. coli* TMDL.

However, the recent chapter 62 revision that became effective on Oct. 14, 2009 states “…that the daily sample maximum criteria for E. coli set forth in Part E of the ‘Supporting Document for Iowa Water Quality Management Plans’ shall not be used as an end-of-pipe permit limitation.” Therefore, only the geometric mean limit of 126 org./100 ml applies to this facility.

Total Nitrogen: In the 2006 Nitrate TMDL for the Cedar River this facility was assigned a Total Nitrogen WLA of 89.8 tons/year and 492 lbs/day. The WLA was converted to 30-day average and daily maximum limits based on the procedure in the November 20, 2008 memo "Deriving total nitrogen limits from the WLA in the Cedar River TMDL". The final TMDL based total nitrogen limits for this facility are a 30-day average of 934.8 lbs/day and a daily maximum of 1,530.1 lbs/day.

It should be noted that limits were included for various forms of nitrogen in this WLA report. There may be situations where the Total Nitrogen limits based on the Cedar River Nitrate TMDL will control the mass limits for the different forms of nitrogen included in this report.

Chloride and Sulfate: The new chloride and sulfate criteria became effluent on Nov. 11, 2009. The default hardness for background and effluent has been changed from 100 mg/l to 200 mg/l, effective on Nov. 11, 2009.
Chloride criteria are functions of hardness and sulfate concentration, shown as follows:

$$\text{Acute criteria} = 287.8*(\text{Hardness})^{0.205797} *(\text{Sulfate})^{-0.07452}$$
$$\text{Chronic criteria} = 177.87*(\text{Hardness})^{0.205797} *(\text{Sulfate})^{-0.07452}$$

The criteria apply to all Class B waters.

Sulfate criteria, shown in Table 5, are functions of hardness and chloride concentration.

Table 5: Sulfate Criteria

Hardness (mg/l as CaCO3)	Sulfate Criteria (mg/l)		
	Chloride < 5 mg/l	5 mg/l <= Chloride < 25 mg/l	25 mg/l <= Chloride < 500 mg/l
< 100	500	500	500
100<=H<=500	500	(-57.478+5.79*H+54.163*Cl)*0.65	(1276.7+5.508*H-1.457*Cl)*0.65
H> 500	500	2,000	2,000

The criteria defined in Table 5 service as both acute and chronic criteria and apply to all Class B waters.

The acute criteria apply at the end of the ZID, and the chronic criteria apply at the end of the MZ. In this case, 25.0% of the 7Q10 flow and 2.5% of the 1Q10 flow in Winnebago River were used as the Mixing Zone (MZ) and Zone of Initial Dilution (ZID), respectively

The default chloride and sulfate concentration for both background water and effluent are 34 and 63 mg/l, respectively.

TDS:
Effective Nov. 11, 2009, the site-specific TDS approach is no longer applicable; instead the new chloride and sulfate criteria became applicable. However, the TDS level should be controlled to a level such that the narrative criteria stated in IAC 567.61.3.(2) be fulfilled.

Iron: The current iron criteria are defined in the 2005 issue paper entitled "Iron Criteria and Implementation for Iowa's Surface Waters (December 5, 2005)". An iron criterion of 1 mg/l applies at the end of the ZID for both general use and designated streams. In this case, 2.5% of the 1Q10 flow was used as the ZID.

pH: Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters "Shall not be less than 6.5 nor greater than 9.0". The criteria apply at the end of the ZID, which is 2.5% of the 1Q10 flow.

5. PERMIT LIMITATIONS: - *Based on the Year 2006 Water Quality Standards & 2002 Permit Derivation Procedure.*

The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. Under the 2002 permit derivation procedure, only for toxic parameters is the monitoring frequency considered in the calculation of final limits.

6. WET TEST RATIO

All major facilities are required to conduct an annual acute WET test. Use 98.5% effluent and 1.5% dilution water for the WET test.